WHAT IS CLAIMED IS:

1. A method for monitoring protein synthesis in a protein synthesis system, the method comprising:

providing a marker for protein synthesis in the system, said marker being detectable through detection of electromagnetic radiation;

detecting electromagnetic radiation emitted from the system; and

analyzing said emitted radiation to monitor protein synthesis activity in said system.

2. The method of claim 1 wherein the system comprises a bacterium or bacterial culture.

3. The method of claim 1 wherein the system comprises at least one cell.

4. The method of claim 3, wherein the system comprises at least one of a cell-line or a cell culture.

5. The method of claim 1 wherein the system comprises a cell-free protein translation system (*in-vitro* translation system).

6. The method of claim 1 wherein one or more of ribosomes, ribosomal RNA, ribosomal proteins, tRNAs, or amino acids in the system are artificially adapted to provide said marker.

7. The method of claim 1 wherein said marker comprises at least a portion of one or more of natural ribosomes, ribosomal RNA, ribosomal proteins, tRNAs, or amino acids.

8. The method of any of claims 1-7 wherein said marker comprises at least one photo-active component.

9. The method of any of claims 1-8, wherein said emitted radiation comprises radiation obtained by energy transfer between at least two of a plurality of components of the system.

10. The method of claim 9 wherein said marker comprises at least one fluorescent donor-acceptor pair.

11. The method of claim 10, wherein said emitted radiation comprises a FRET (Fluorescence resonance energy transfer) signal.

12. The method of any of claims 8-11 wherein said emitted radiation comprises a fluorescent signal.

13. The method of any of claims 8-12, wherein at least a portion of said marker comprises at least one of a fluorescent protein, a fluorescent dye, a quantum dot or a luminescent substance.

14. The method of claim 13, wherein said luminescent substance comprises a luminescent protein or portion thereof.

15. The method of any of claims 1-8, wherein said marker comprises a first portion being a fluorescent substance and a second portion for quenching said fluorescent substance.

16. The method of claim 15, wherein said detecting comprises detecting a reduction in emitted radiation.

17. The method of any of claims 8-16, wherein at least a portion of said marker is covalently or non-covalently bound to a tRNA.

18. The method of any of claims 8-17, wherein at least a portion of said marker is covalently or non-covalently bound to at least a portion of a ribosome.

19. The method of claim 18, wherein said portion of said ribosome is at or near at least one of the A site, P site, E site or peptide exit channel site.

20. The method of claims 18 or 19, wherein said at least a portion comprises an amino acid.

21. The method of any of claims 1-20 wherein said detecting comprises irradiating the system with electromagnetic radiation.

23. The method of any of claims 1-21 wherein said emitted radiation is detected with a microscope.

24. The method of any of claims 1-23, adapted to measure emitted radiation from a single ribosome.

25. The method of claim 24, wherein said marker comprises a donor-acceptor fluorescent pair suitable for performing single pair FRET and wherein said emitted radiation occurs upon performing single pair FRET.

26. The method of any of claims 1-23, adapted to measure signals from a plurality of ribosomes.

27. The method of claim 26, wherein said analyzing said emitted radiation comprises performing signal analysis of emitted radiation from said plurality of ribosomes.

28. The method of any of claims 1-27, further comprising:

identifying at least one protein being synthesized through said analyzing said emitted radiation.

29. The method of any of claims 1-28, wherein said detecting is performed in real time.

30. The method of any of claims 1-29, wherein said detecting further comprises:

monitoring protein synthesis by detecting a plurality of protein synthetic processes over a period of time.

31. The method of claim 30, wherein said plurality of protein synthetic processes comprise a plurality of interactions between a ribosome and a plurality of different tRNA molecules.

32. An apparatus for measuring protein synthesis by a protein synthesis system, said apparatus comprising:

a container for containing a plurality of components for the system, wherein at least one component is capable of emitting electromagnetic radiation due to a protein synthesis activity;

a detection system to measure emitted radiation from the system; and

a computational device to analyze said emitted radiation and determine the protein synthesis activity in said system.

33. The apparatus of claim 32 wherein the system comprises a bacterium or bacterial culture.

34. The apparatus of claim 32 wherein the system comprises at least one cell.

35. The apparatus of claim 34, wherein the system comprises at least one of a cell-line or a cell culture.

36. The apparatus of claim 32 wherein the system comprises a cell-free protein translation system (*in-vitro* translation system).

37. The apparatus of claim 32 wherein one or more of ribosomes, ribosomal RNA, ribosomal proteins, tRNAs, or amino acids in the system are artificially adapted to provide said marker.

38. The apparatus of claim 32 wherein said marker comprises at least a portion of one or more of natural ribosomes, ribosomal RNA, ribosomal proteins, tRNAs, or amino acids.

39. The apparatus of any of claims 32-38 wherein said marker comprises at least one photo-active component.

40. The apparatus of any of claims 32-39, wherein said emitted radiation comprises radiation obtained by energy transfer between at least two of a plurality of components of the system.

41. The apparatus of claim 40 wherein said marker comprises at least one fluorescent donor-acceptor pair.

42. The apparatus of claim 41, wherein said emitted radiation comprises a FRET (Fluorescence resonance energy transfer) signal.

43. The apparatus of any of claims 39-42 wherein said emitted radiation comprises a fluorescent signal.

44. The apparatus of any of claims 39-43, wherein at least a portion of said marker comprises at least one of a fluorescent protein, a fluorescent dye, a quantum dot or a luminescent substance.

45. The apparatus of claim 44, wherein said luminescent substance comprises a luminescent protein or portion thereof.

46. The apparatus of any of claims 32-39, wherein said marker comprises a first portion being a fluorescent substance and a second portion for quenching said fluorescent substance.

47. The apparatus of claim 46, wherein said detection system detects a reduction in emitted radiation.

48. The apparatus of any of claims 39-47, wherein at least a portion of said marker is covalently or non-covalently bound to a tRNA.

49. The apparatus of any of claims 39-48, wherein at least a portion of said marker is covalently or non-covalently bound to at least a portion of a ribosome.

50. The apparatus of claim 49, wherein said portion of said ribosome is at or near at least one of the A site, P site, E site or peptide exit channel site.

51. The apparatus of claims 49 or 50, wherein said at least a portion comprises an amino acid.

52. The apparatus of any of claims 32-51 wherein said detection system irradiates the system with electromagnetic radiation.

53. The apparatus of any of claims 32-52 wherein said detection system comprises a microscope.

54. The apparatus of any of claims 32-23, wherein said detection system measures emitted radiation from a single ribosome.

55. The apparatus of claim 54, wherein said marker comprises a donor-acceptor fluorescent pair suitable for performing single pair FRET and wherein said emitted radiation occurs upon performing single pair FRET.

56. The apparatus of any of claims 32-53, wherein said detection system measures a plurality of signals from a plurality of ribosomes.

57. The apparatus of claim 56, wherein said computational device performs signal analysis of emitted radiation from said plurality of signals.

58. The apparatus of any of claims 32-57, further comprising equipment for identifying at least one protein being synthesized through said analyzing said emitted radiation.

59. The apparatus of any of claims 32-28, wherein said detection system operates in real time.

60. The apparatus of any of claims 32-59, wherein said detection system monitors protein synthesis by detecting a plurality of protein synthetic processes over a period of time.

61. The apparatus of claim 60, wherein said plurality of protein synthetic processes comprise a plurality of interactions of a single ribosome with a plurality of different tRNA molecules.

62. A method for analyzing a chemical compound library, said method comprising:

Administering each of the compounds to a protein translation system;

Measuring a response of said system according to the method of any of claims 1-31;

Analyzing said measurement to provide information about said compound.

63. An apparatus for analyzing a chemical compound library, comprising: a well array plate comprising a plurality of wells:

a robot for placing a protein synthesis system into the wells;

a robot for administering chemical compounds into said wells; and

an apparatus according to any of claims 32-61 to analyze protein synthesis by said system.

64. A method for determining cellular protein pathways, comprising:

selecting a cellular or bacterial culture;

placing said culture in a plurality of sample containers;

subjecting said culture to at least one condition in each of said containers;

measuring protein synthesis in each of said containers according to the method of claims 1-31; and

analyzing protein expression patterns in all containers to determine protein pathways.

65. A method for ribosome labeling to allow protein synthesis monitoring, said method comprising:

selecting a fluorescent probe;

selecting a location on at least one of a ribosomal RNA or on a ribosomal protein according to at least one of a characteristic of said probe or a characteristic of at least one of said ribosomal RNA or said ribosomal protein; and

attaching said probe to said location.

66. The method of claim 65, wherein said selecting said fluorescent probe is performed according to at least one of a suitable excitation or emission property of said probe.

67. A method for protein production monitoring, said method comprising:

selecting a protein synthesis system for PSM analysis;

selecting a fluorescent probe;

selecting a location on at least one of a ribosomal RNA or on a ribosomal protein according to at least one of a characteristic of said probe or a characteristic of at least one of said ribosomal RNA or said ribosomal protein;

attaching said probe to said location to perform PSM; and

analyzing signals from said probe to monitor the protein synthesis system.

68. A method for detecting protein synthesis in a protein synthesis system, the method comprising:

providing a marker for protein synthesis in the system, said marker having a label;

attaching said marker to at least one component of the system; and

detecting said label to determine protein synthesis activity in the system.

69. Use of a marker for detecting a protein synthetic act in real time.

70. The use of claim 69, wherein said protein synthetic act comprises an interaction between a tRNA and a ribosome.

71. The use of claim 70, wherein at least one of said ribosome and said tRNA features a marker.

72. The use of claim 71, wherein both said ribosome and said tRNA feature said marker.

73. The use of claims 71 or 72, wherein said tRNA comprises a naturally fluorescent amino acid.

74. The use of claims 71 or 72, wherein said ribosome comprises a label.

75. The use of claim 74, wherein said label comprises a quantum dot.

76. The use of claim 69, wherein each of said ribosome and said tRNA features a portion of a marker.

77. The use of claim 76, wherein a first portion comprises a fluorescent acceptor and a second portion comprises a fluorescent acceptor.

78. The use of any of claims 69-77, wherein if said ribosome comprises a marker or a portion thereof, said marker or said portion thereof is covalently or non-covalently bound to ribosomal protein L1, ribosomal protein S1 or a combination thereof.

79. The use of any of claims 69-78, for performing a screening assay according to said detecting said protein synthetic act.

80. The use of claim 79, wherein said screening assay is for detecting a pathological condition in a subject.

81. The use of any of claims 69-78, for pathway elucidation through said detecting said protein synthetic act.

82. The use of any of claims 69-78, for cell state analysis through said detecting said protein synthetic act.

83. Use of a marker for identifying a protein being synthesized by a protein synthetic process in real time.

84. Use of a marker for identifying a tRNA species being used in a protein synthetic process in real time.

85. Use of a marker for identifying an amino acid species being used in a protein synthetic process in real time.

86. Use of a marker for identifying a codon species being used in a protein synthetic process in real time.